



# **Risk Management for NASA Programs**

***Are We Ready for Exploration?***

Bryan O'Connor

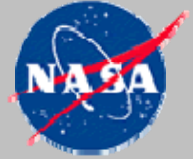
Chief, OSMA

NASA Risk Management Conference VI

Orlando, Florida

6 December 2005

## ***Is Risk Management Important?***



*The terrain is to be assessed in terms of distance, difficulty or ease of travel, dimension, and safety.*

***Sun Tzu***

***The Art of War***

***5<sup>th</sup> Century B.C.***



## CAIB Root Cause Conclusion

NASA exhibited “*cultural traits and organizational practices* detrimental to safety”:

- *reliance on past success*
- *organizational barriers to effective communications*
- *lack of integrated management*
- *informal decision-making processes*

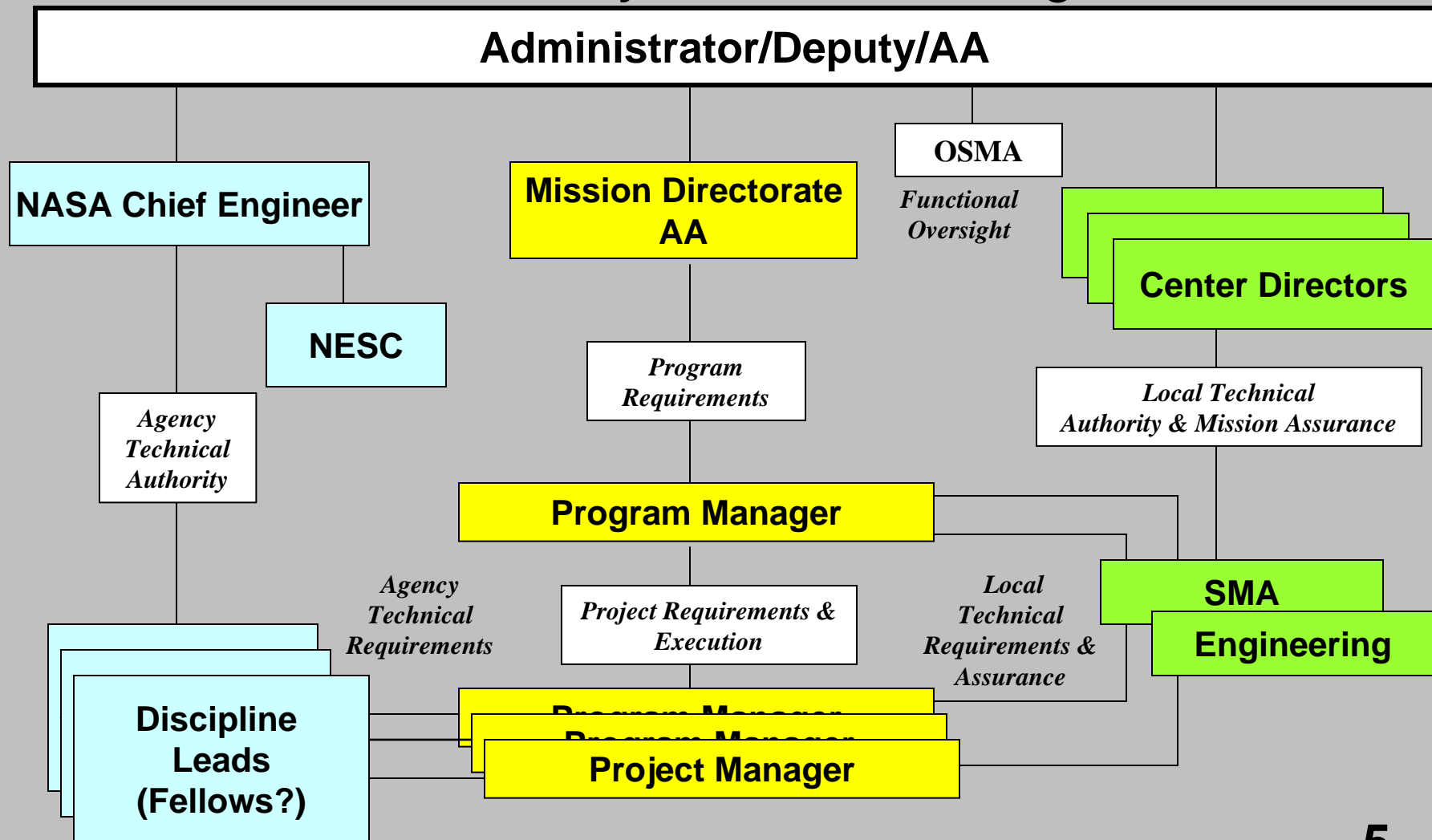


## ***Risk Related Findings/Observations of CAIB***

- Engineering Models (validation?)
- Integrated Risk Analysis (scope?)
- Risk Communications (adequate? independent?)
- Public Risk Assessment/Policy (complete?)
- Hazard Analysis (risk informed?)
- Micrometeoroid and Orbital Debris Analysis (used?)
- Trend Analysis (adequate?)
- Training of Engineers and Managers (adequate?)



# The Organization (Notional) Technical Authority/Assurance, Programs, Centers

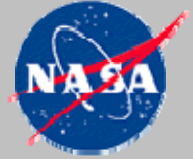




## ***ITA: More emphasis on System Safety Engineering (including Risk Assessment)***

- The Technical Authority is **independent** of the program
- The engineering community will take a major role in system safety engineering **(every engineer a safety engineer)**
  - Own safety related technical requirements
  - Actively participate in system safety engineering tasks
  - Provide the program “technically acceptable” alternatives
  - Accountable for system safety results (within scope)
  - Design engineers: Integrate system safety, reliability, quality engineering into risk trades
- The SMA organizations will **facilitate, coach, train, and assure** all of the above

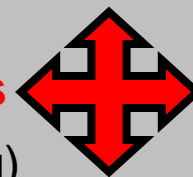
# *The Exploration Risk Iceberg*



# *Risk Management for Exploration*



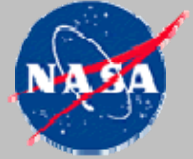
- Known Knowns: (*Systems Engineering and Program Management*)
  - Disciplined program and mission **management processes and people**
- Known Unknowns: (*Continuous Risk Management*)
  - **Reduce uncertainties** with analysis, ground and flight test
  - Manage **residual risk** (including uncertainty) with conservative procedures and contingency plans...and **tell them why, not just what!**
- Unknown Knowns: (*Continuous Process Improvement*)
  - Enforce rigorous **supplier quality** programs
  - **Communications , Communications, Communications**
  - Improve data **analysis** tools and techniques (e.g. trending)
- Unknown Unknowns: (*Continuous Research, Test and Evaluation*)
  - Exercise **Engineering Curiosity**
  - Constantly **challenge assumptions**, models and analyses








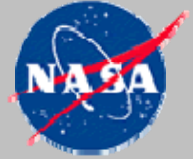
# ***Southwest Airlines***

## ***What is their Secret to Flight Safety?***



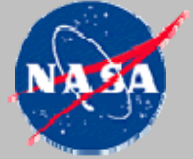
- **Communications** 
- **Training**
- **Communications** 
- **Fly the high risk parts of the flight manually**
- **Communications** 

# ***Risk Assessment Exploration Relevant Questions***

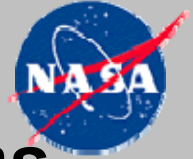


- Are we doing this as a legitimate part of **systems engineering** for the program?
- Do we **understand the system** we are analyzing?
- Are we properly accounting for **past success and failure**?
- Are we properly accounting for **uncertainty**?
- Are we including **all the players** in the assessment?
- Are we **doing the math** properly?
- Do we have an **independent peer review** in place?
- Do we have the **expertise** for all of the above?

# ***Risk Communications Exploration Relevant Questions***



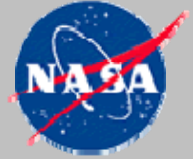
- Is the 5 X 5 matrix suited to **Design Reviews and Readiness Reviews**?
- When we compare risk assessments of different organizations, are they using the **same rules**?
- Are we inappropriately using PRA results to **predict accident rates** to our stakeholders?
- Are we properly communicating quantitative risk assessment results (including **uncertainty and assumptions**)?
- Are we comparing **apples to apples** in our risk trades?



## ***Accepting Residual Risk: More Questions***

- With the new emphasis on independent technical authority, does the **PM still accept residual risk**?
- If so, is he/she speaking for the actual **risk taker**?
- If so, how does the program involve the risk taker?
- Who accepts residual risk on behalf of the **public**?
- Are we **smart enough buyers** to legitimately accept risk for out-of-house development work?
- What is NASA's safety accountability to contractor, COTS, and prize competitor **flight and ground crews**?

# ***Are We Properly Analyzing the Risk?***

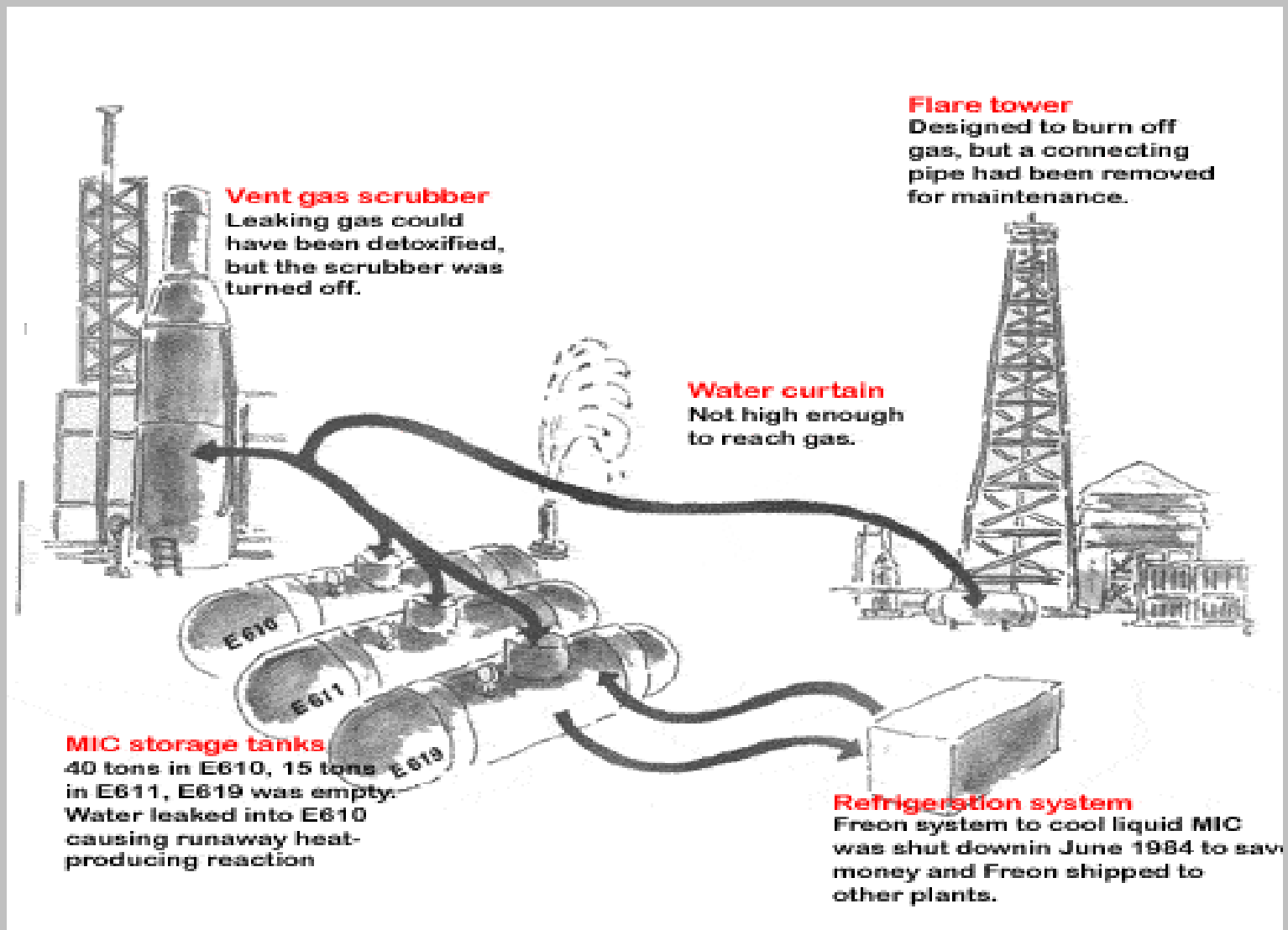


**Delta II Mishap**

**Cape Canaveral, 1997**



# Bhopal: Risk Mitigation in Place?





## ***New Orleans: Accepting Risk with Eyes Closed?***

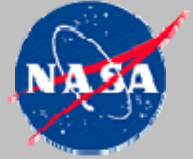


**Hurricane Betsy 1965**



**Hurricane Katrina 2005**

## Are We Too Risk Averse to Explore?



*To your own discretion therefore must be left the degree of danger you risk, and the point at which you should decline, only saying we wish you to err on the side of your safety, and to bring back your party safe even if it be with less information.*

Thomas Jefferson

Letter to Meriwether Lewis: 1803



***Ex Scientia Salus et Successus***  
***(From Knowledge: Safety and Success)***

